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## **An Economic Study of the Richmond Hill Disc Golf Course**

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### **Abstract**

The sport of disc golf has grown, and is still growing, at an astounding rate. Despite all of disc golf's positive qualities, it can be harmful to the natural ecology of the area in which it is played. Disc golf has been documented to cause such environmental degradation as greatly increased erosion, soil compaction, significant trampling of undergrowth and loss of vegetative cover, as well as persistent damage to trees, such as the stripping of bark, leaves, and branches and indentations and nicks made by the discs, which can result in tree death. Because of the sport's increasing popularity and negative ecological impacts, it is important to know whether the benefits of disc golf courses are worth the cost. Moreover, because there are mitigation techniques available to offset the negative impacts of disc golf such as behavioral modification, tree-wrapping, and mulching, it would also be beneficial to know whether players would be willing to pay, and how much, to help fund mitigation costs. Using the non-market valuation survey techniques of contingent valuation and contingent behavior analysis, this study examines players' recreational demand for disc golf at Richmond Hill Disc Golf Course in Asheville, NC, and their willingness to pay (WTP) to maintain the park. Results of this study indicate that there is a high demand for disc golf recreation at Richmond Hill, players value course maintenance positively, and are willing to change their behavior to offset negative impacts. The data collected from this study provides helpful information for making decisions, such as expected levels of course use and how to fund maintenance, at proposed and existing disc golf courses.

### **1. Introduction**

Disc golf is one of the fastest growing sports in the world; each year more than 100 new courses are established, and thousands of new players take up the game <sup>1</sup>. There are more than 3,000 formal disc golf courses in the United States, and there are courses in more than 20 countries around the rest of the world <sup>2,3</sup>. Large urban cities and small towns alike are installing courses because of increased public demand and the relative benefits of this kind of outdoor activity versus some other types of publically-supported recreation. For example, in comparison to traditional outdoor sporting areas, disc golf courses require minimal maintenance because there is no need for pesticides, mowing or mass tree clearing; additionally, most courses are free to access, making the sport more affordable for players <sup>1,4</sup>.

Despite the relative advantages associated with disc golf, environmentalists voice concerns about the sport's negative impacts on the environment. Disc golf is known to cause several kinds of environmental degradation ranging from ground compaction to tree death <sup>5,6</sup>. While it has become clear to environmentalists that the sport has undesirable consequences for the environment, many players are still unaware of the negative environmental effects of disc golf. A study of disc golf at three different courses in the southern United States found that players were not only unaware of the damage they were causing, but that they were willing to change their behavior to mitigate some of these problems <sup>7</sup>. Aside from behavior modification, there are mitigation practices that can be used to offset some of the negative effects of disc golf.

Western North Carolina (WNC) is home to dozens of major disc golf courses certified by the Professional Disc Golf Association (PDGA); the most popular course is located in Asheville, the Richmond Hill Disc Golf Course (RHDGC) <sup>8</sup>. The information collected from an economic valuation of a disc golf course is useful, because it can be helpful in determining whether to build future courses and how to maintain the ones that already exist. Furthermore, a study to get at the players' willingness to pay (WTP) to mitigate ecological damages they cause is useful for a community considering taking steps to abate this harm. The WTP aspect is of special importance because cities have budget constraints and there is a question of fairness as to why all tax payers should have to pay for damages caused by a few. Through a contingent valuation survey of players at RHDGC, this study examines demand for recreation at RHDGC and assesses the value of the course to players through estimates of players' WTP for annual course maintenance.

## **2. Background**

### **2.1 Disc Golf**

The sport of disc golf is rapidly gaining popularity and is considered to be one of the world's fastest growing sports, experiencing a growth rate in players around 10-20% per year <sup>9</sup>. Disc golf, sometimes referred to as 'Frisbee golf,' is a sport played very similarly to traditional golf. The main difference between disc golf and traditional 'ball golf' are the specially designed discs and baskets used for disc golf that act as the 'golf ball' and holes would in the traditional sport.

To play disc golf, specially-designed plastic discs are thrown at metal poles or elevated baskets which act as targets. As in 'ball golf,' the object is for players to get the lowest score by getting your disc into the baskets in as few throws as possible <sup>2,3</sup>. Usually, disc golf courses are either 9- or 18-holes; playing an entire 18-hole course can take several hours. Courses are designed with the natural lay of the land in mind, using natural obstacles such as trees, ponds, and/or hills to make the courses more challenging. There are many suitable landscapes for disc golf courses, ranging from open fields to beaches and forests <sup>10</sup>. Additionally, disc golf is an inexpensive sport that can be played by people of all ages, genders, and skill levels making it accessible to a wide group <sup>2,3,4</sup>.

### **2.2 The Problem**

Environmental problems are present in nearly every facet of our daily activities, with sport being of no exception <sup>4</sup>. Due to low course start-up and maintenance costs, a disc golf course is an attractive option for cities looking to add a new recreational activity to their community. Disc golf is an appealing choice for players because equipment costs are minimal and most courses do not charge user fees <sup>1,4,7</sup>. These qualities make disc golf an accessible sport to many; thus, a community course seems to be a worthwhile public investment. Additionally, disc golf courses are much easier on the environment than traditional outdoor sports complexes such as conventional golf courses or soccer fields. For example, with disc golf there is no need for the use of pesticides or other chemicals to maintain a green space, mowing, or tree cutting to design the course <sup>4,6</sup>. While disc golf has been praised for having minimal environmental impacts, there are negative consequences associated with the sport.

Disc golf has been documented to cause environmental damages in certain places like hilly or mountainous areas and forest ecosystems. However, the sport of disc golf is less harmful in areas where foot traffic isn't as impactful on the environment, like a sandy beach or a grassy field. Some of the negative environmental impacts associated with the sport include: greatly increased soil erosion, soil compaction, significant trampling of undergrowth and the loss of vegetative cover, as well as persistent damage to trees made by discs, such as the stripping of bark, leaves, and branches and indentations and nicks, which can result in tree death <sup>5,6</sup>. The impacts of disc golf at RHDGC are real and visible; at the park one can see damage to trees and undergrowth, as well as heavy soil compaction and erosion throughout the course <sup>11</sup>. The adverse consequences of disc golf combined with the increased demand for the sport suggests more environmental damage is likely to occur in the future.

### **2.3 Richmond Hill Park**

At 183 acres, Richmond Hill Park is Asheville's largest wooded city park. The park's location is adjacent to the French Broad River and connects with a neighboring wetland area; the park itself is forested and has a hilly terrain.

Because of Richmond Hill's great size and location, the park offers a large variety of outdoor activities such as disc golf, hiking, mountain biking, trail running, bird watching, dog walking, and general outdoor enjoyment. While Richmond Hill has plenty to offer outdoor enthusiasts, its most popular attraction is the disc golf course<sup>12</sup>.

Established in 2001, the RHDGC was designed for serious players of varying skill levels. The course is a full 18 holes and is heavily forested with many changes in elevation, making it more challenging than your standard course. In addition to being woody and hilly, RHDGC is lengthy at 6,093 feet. The course's primary tee boxes are placed for advanced and/or professional players, though several holes have alternate tees set up for amateur skill level. With all of these attributes, RHDGC is debatably the toughest and most thrilling course to play in America<sup>12, 13, 14</sup>.

## 2.4 Purpose of Research

Presently, Asheville's parks department has taken few steps to abate the environmental damage caused by disc golf at Richmond Hill. However, before the city spends a portion of its budget to address these damages, it is important to know whether the benefits are greater than the costs of doing so. It would also be helpful for the city to know whether players are willing to help fund the costs of abatement, how much they would be willing to donate toward the course's maintenance costs, and whether or not they would be willing to change their behavior to offset damages.

Prior to this study, there has never been an economic assessment of this kind to determine a course's value to players. A study of this type, however, is of great importance, because before attempting to mitigate the environmental costs of disc golf, we need to know how the people benefiting from these courses actually value them. This is important to know because it is not efficient to spend public funds on a park that does not hold value to its users. With the information from this research, park management should be able to better decide whether or not to build future courses and/or to maintain the ones that presently exist.

## 3. Theory and Literature Review

### 3.1 Economic Theory

Richmond Hill, like many parks and/or disc golf courses, exhibits characteristics of both common-pool resources (CPR) and public goods. CPRs are both rival in consumption and non-excludable. A CPR is non-excludable in the sense that it is extremely challenging to keep people from using them; they are rival in consumption because each individual's use of a CPR can detract from benefits that others may appreciate<sup>15</sup>. RHDGC is non-excludable because it is a public park that anyone may access, and demonstrates rival consumption because, despite the park's large size, there is still a maximum capacity of people that can enjoy the park at one time without reducing others' enjoyment. When the park becomes over-congested, it becomes difficult to play an enjoyable round of disc golf due to the increased waiting times between holes and the potential increase of conflict and/or disruption of play from competing activities (e.g. bikers, hikers, disc golfers, etc., all using the same park). The RHDGC is non-excludable in the sense that anyone can have access to the park and its disc golf course. Thus, the recreational benefits of RHDGC are what resemble CPRs. Two of the most common examples of CPRs that are of great concern are fisheries and forests; RHDGC is almost 180 acres of public, forested land.

RHDGC is an open-access CPR, meaning that anyone can enter the resource. Open-access resources are likely to be overused, and in the worse-case scenario, destroyed<sup>15</sup>. The major problem with CPRs is that their property rights tend not to be well-defined<sup>16</sup>. Hardin's Tragedy of the Commons occurs when people must share the same resource without well-defined property rights<sup>17</sup>. A property right is the select power to regulate how a resource is utilized, whether that resource is owned by private individuals or by government<sup>18</sup>. According to Hardin, the Tragedy of the Commons will happen when resource users don't take into account the fact that their use of the resource detracts from others' consumption and/or enjoyment, and this leads to overuse of the resource<sup>16, 17</sup>.

Resources of the common-pool nature may be governed and managed by a broad range of institutional organizations such as: government, private or community ownership<sup>15</sup>. RHDGC is technically owned by the City of Asheville Parks Department. However, because of the WNC Disc Golf Association and the Southern Off-Road Bicycling Association, as well as a local grassroots environmental advocacy group, the WNC Alliance, that act as stewards to the land at Richmond Hill in addition to the City, it could be argued that RHDGC also exhibits qualities of a community managed CPR as well as a governmentally owned one.

In addition to demonstrating attributes of CPRs, RHDGC also demonstrates characteristics of a public good. A public good is like a CPR in the sense that they are both non-excludable; however, public goods, unlike CPRs, are non-rival as well as non-excludable. Some examples of public goods include national parks, clean air, and national security. We call these goods non-rival because consumers can use these resources without reducing their availability and/or quality to others<sup>16</sup>. RHDGC is like a public good because the forest ecology of the area offers ecosystem services that are non-rival and non-excludable such as carbon sequestration, oxygen cycling, erosion control and pollination. Thus, it can be said that the non-recreation benefits of RHDGC are public goods, while the benefits associated recreation at RHDGC are CPRs.

Often with public goods and resources, the users care little about the other consumers of the good. Keeping this in mind, individuals have an incentive to free-ride, relying on others to pay for the provision of the resource. Because of the free-rider problem, public goods are frequently under-provided by markets<sup>16</sup>. The free-rider problem is one reason public goods are not provided privately. When the free market is left to provide public goods, free-riding behavior leads to underallocation, which is why public goods, such as publically-owned parks, are often provided and managed by government. If people were left to provide parks privately, there would be very few parks. However, it is important to note that there are some privately owned parks (e.g. Grandfather Mountain, NC) and disc golf courses (e.g. Avery's Spring, NC), but they are not free to access. It costs money to get into the Grandfather Mountain State Park, and Avery's Spring Disc Golf Course is accessed by invite only. One solution to issues with free-riders is to calculate user WTP for the resource and then to implement a partial contribution program, where consumers make the supply of a public good possible when no individual can supply the good alone, by helping to pay for it. However, free-riding can still persist even with outside contributions<sup>16</sup>.

### 3.2 Contingent Valuation Method

The contingent valuation method (CVM) is an approach to non-market valuation (NMV) used for placing monetary values on environmental resources and/or amenities not sold and purchased in traditional markets<sup>20</sup>. Environmental goods and services can be valued in different ways. One of these ways is non-use value, where an individual places a value on an environmental amenity without necessarily interacting with the resource in an apparent way. An example of a type of non-use value is an existence value. An existence value is when individuals draw utility through simply knowing that a species or an environmental good/service exists in nature. CVM is survey-based and uses stated preference NMV versus revealed preference techniques; this means that CVM asks respondents questions directly instead of extracting their preferences indirectly from their consumer behavior. Questions in a contingent valuation (CV) survey ask respondents to indicate their WTP for protection of, or improvements to, the environment such as species preservation or increased efficiency in the management of resources<sup>19, 20</sup>. Basically, CVM seeks to create a monetary value for a good/service that otherwise has no dollar value that can be shown in a marketplace.

At the heart of CV is the survey; with a well-conceived and carefully-designed survey respondents can be coaxed into disclosing the value they have for the amenity in question. The goal is not to inspire a positive valuation but rather to extract the individual's underlying preference for a resource. CVM is founded on the idea that people have distinct preferences for environmental goods/services just as they do for goods/services in the market, and when posed the right questions, will expose their individual value for the resource<sup>20, 21</sup>.

In 1993, the National Oceanic and Atmospheric Administration (NOAA) put together a panel to address the development of non-use values in environmental damage litigation. The goal of the panel was to assess the reliability of CV in approximating environmental and non-use values<sup>20</sup>. The panel maintained that, if the survey is crafted to provoke rational answers, CVM is dependable for estimating non-market prices for environmental goods and services<sup>22</sup>. While CV studies are designed to obtain descriptive information, the research often contains hypothetical situations and responses that are rather subjective. To offset some of the bias of survey responses and the over- or under-statements of actual WTP, NOAA recommended that CV surveys be crafted as self-contained polls where respondents choose whether to tax themselves for the enhancement of an environmental good and/or service<sup>22</sup>.

A well-designed CVM study will focus on an unambiguous and realistic situation and will include a closed-ended WTP question within its survey<sup>20, 23</sup>. The nature of CV surveys is hypothetical, thus respondents must be made fully aware of the impact of their choices and how it may affect their future; there needs to be an understanding of where the respondents' contribution will go and for what specific purpose it will be used<sup>20</sup>. Posing a WTP question in a closed-ended way will make respondents more likely to answer truthfully, as they will have no reason not to<sup>20</sup>.

Another important aspect of CVM surveys is the choice of an appropriate ‘payment vehicle’ (PV), which is usually specified as a way of securing an environmental or some other outcome. A PV can be described as the framework, or format, of a choice or type of payment. Examples of typical PVs include: levies on income taxes, water or land rates, increased park entrance fees and increased sales taxes <sup>24</sup>. If the appropriate payment vehicle is not chosen, then a study may get a lot of protest bid responses. A protest bid is where people who reject the idea of having to pay per use fees or higher government taxes may answer with artificially low WTP values <sup>20, 25</sup>. Private donations, unlike taxes, are voluntary; using private donations as the payment vehicle may influence people to respond with a more realistic estimate of their WTP <sup>20</sup>.

## 4. Methodology

In this research, a CVM study was designed to assess the demand for recreation at RHDGC, as well as user WTP and willingness to change behavior. For the survey’s WTP question, the payment vehicle was given as an annual donation rather than a tax or a per use fee to reduce protest bids. In addition to questions about RHDGC and player behavior, the survey also asked basic demographic questions. (See Appendix I: Survey Instrument).

Prior to its implementation, UNC-Asheville’s Institutional Review Board (IRB) approved the survey protocol. To comply with the IRB’s rules for social research, survey respondents were required to be at least 18 years old. To get a diverse set of responses the survey was conducted at RHDGC on six different days, including varying days of the week, between June and August, 2013. Conducting the survey on different days and times during the week over the course of three months enabled the survey to reach as wide a range of disc golfers as possible. To encourage participation, respondents were offered entry into a raffle for a chance to win one of two incentives, a \$50 or \$25 gift certificate to Second Gear, a local sporting goods business. A total of 73 surveys were collected.

## 5. Survey Results

### 5.1 Demographics

The typical respondent to this survey was a 35 year old male who predominantly has been living in or visiting WNC for about 16 years (n = 71). The majority of respondents permanently reside in Asheville (55.9%), however many live in WNC as well (39.7%); the remaining 4.4% live throughout the rest of the United States (4.4%) (n = 68). The average number of miles players travel to get to RHDGC was 23.2 miles (n = 69). The majority of players, about 97%, indicated that their usual mode of transportation to RHDGC was by car (n = 72). Disc golfer demographics and characteristics are displayed in Table 1.

Table 1. disc golfer demographics and characteristics.

Average Age (n = 71)	35
Average Income (n = 70)	\$49,535 *
Percent Male (n = 71)	85.9%
Average Number of Years Living in or Visiting WNC (n = 71)	16.2 years
Percent Living in Asheville (n = 68)	55.9%
Percent Living in WNC, but not in Asheville (n = 68)	39.7%
Percent Living Somewhere Other than WNC (n = 68)	4.4%
Average Number of Miles to Travel to RHDGC (n = 71)	23.2 mi.
Percent Who Travel to RH for Activities Other than Disc Golf (n = 69)	40.6%
Most Popular Activity at RHDGC Among Players Besides Disc Golf (n = 69)	Hiking (30.4%)
Mode of Transportation (n = 72)	Car (97.2%)
* Calculated using the midpoint of the annual household income intervals.	

Approximately 41% of respondents indicated they travel to RHDGC for recreation other than disc golf, with the most popular activity being hiking (n = 69). Outside of the setting of RHDGC, the four most popular outdoor activities that respondents participate in other than disc golf are hiking/backpacking (88.6%), camping (82.9%), walking/running (64.3%), and canoeing/kayaking/rafting (64.3%) (n = 70).

Because annual household income was presented in the survey as a range of numbers, the average annual income was estimated using the midpoint of the intervals. The result of this approximation is that players have an average estimated annual household income around \$49,535 (n = 70). The distribution of income (Figure 1) indicates that the largest number of respondents, 25.7%, reported income between \$15,000-\$29,000. About 27.7% of respondents had no education past their high school degree, 15.2% had their associate's degree, 41.6% had a bachelor's degree, and 12.5% of players had a degree beyond their bachelor's (n = 72) (Figure 2).

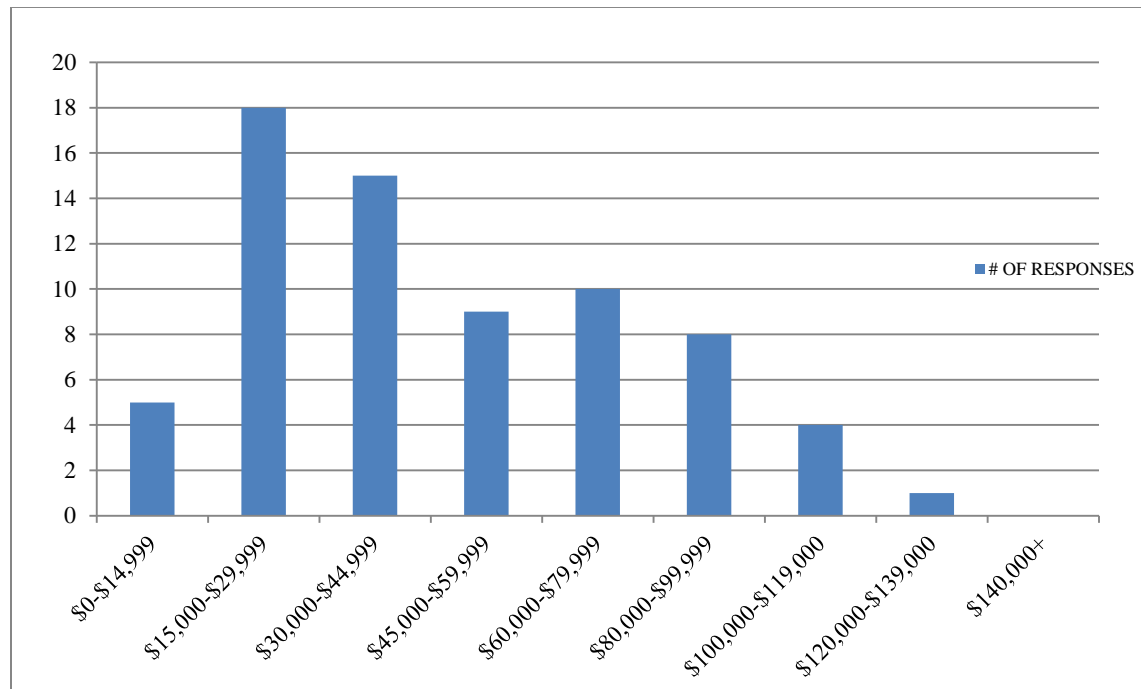


Figure 1. distribution of income (n = 70).

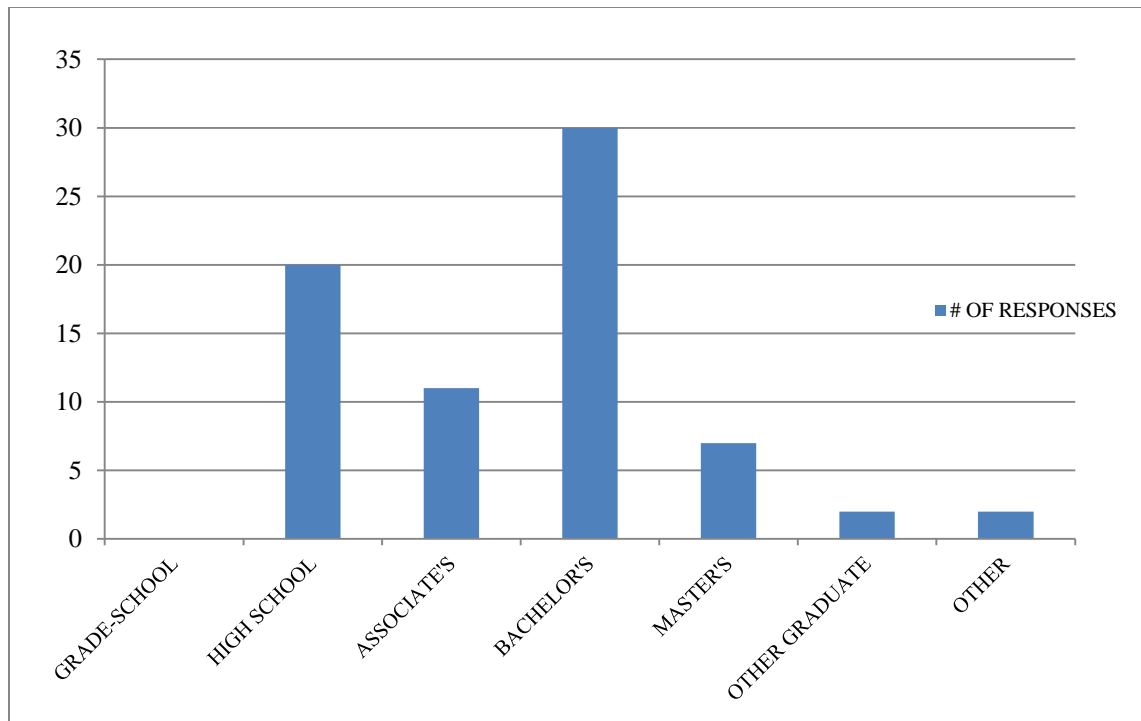


Figure 2. distribution of education level (n = 72).

## 5.2 Playing Characteristics

Of the 73 disc golfers surveyed, a vast majority used RHDGC as their primary place to play; 78.1% of players said most of their disc golf activity was at Richmond Hill. In fact, 76% of respondents said that RHDGC was their favorite course (n = 70). Among those who do not primarily play disc golf at RHDGC, Black Mountain, Lake Julian, and Waynesville were the most popular destinations for players. The average number of days per year survey participants spent playing disc golf was about 122 days (n = 73). The average number of days spent playing disc golf specifically at RHDGC was around 81 days per year for WNC locals (n = 65) and roughly 15 days per year for those not living in WNC (n = 11). (See Table 2).

Table 2. playing characteristics.

Average Number of Days/Year Spent Playing Disc Golf (n = 73)	121.8 days
Average Number of Days/Year Spent Playing Disc Golf at RHDGC (n = 65)	81.1 days
Percent Who Primarily Play Disc Golf at RHDGC (n = 73)	78.1%
Average Number of Days/Year Out-of-Town Respondents Travel to RHDGC (n = 11)	14.7 days
Percent Who Said RHDGC was their Favorite Course (n = 70)	75.7%
Percent Aware of Environmental Impact (n = 70)	80%
Percent Who are Concerned About Environmental Impact (n = 69)	55.1%

In addition to being asked about general playing habits, respondents were asked to indicate whether they were aware of and/or concerned about the environmental impacts of their sport. Prior to this question in the survey was a brief description of the negative environmental impacts of disc golf (see Appendix 1, Survey Question No. 9). According to the survey results, an overwhelming 80% of players were aware of the environmental degradation they



were causing before taking this survey, while only 55% indicated they were concerned about this damage (n = 70). Disc golfer playing characteristics are summarized in Table 2.

### 5.3 Willingness to Pay

The WTP question asked players to estimate the amount they would be willing to pay annually to support the maintenance of RHDGC in order to offset environmental damages. Most respondents said they would be willing to pay \$25 per year toward the maintenance of RHDGC, while the second most popular response for the annual WTP question was \$50 (see Figure 3), and the average WTP was around \$44 per year (n = 70) (Table 3). Approximately 88.6% of respondents answered they had WTP greater than zero. As a follow-up to the WTP question, respondents were asked for what reason(s) they were not willing to donate more than they indicated; results of this question are displayed in Table 4. The most popular reason players were not willing to donate more than indicated was that they could not afford it. Another common reason for people not being willing to donate more was specified under the “other” category of the question; about 50% of the respondents who chose the “other” option indicated that they would rather donate their time than their money. When people said they would not be willing to make an annual donation, they were asked if they would be willing to make a one-time donation. For the 9% of players that responded they would be willing to make a one-time donation, as opposed to an annual donation, the average amount they would be willing to give is \$21 (n = 6).

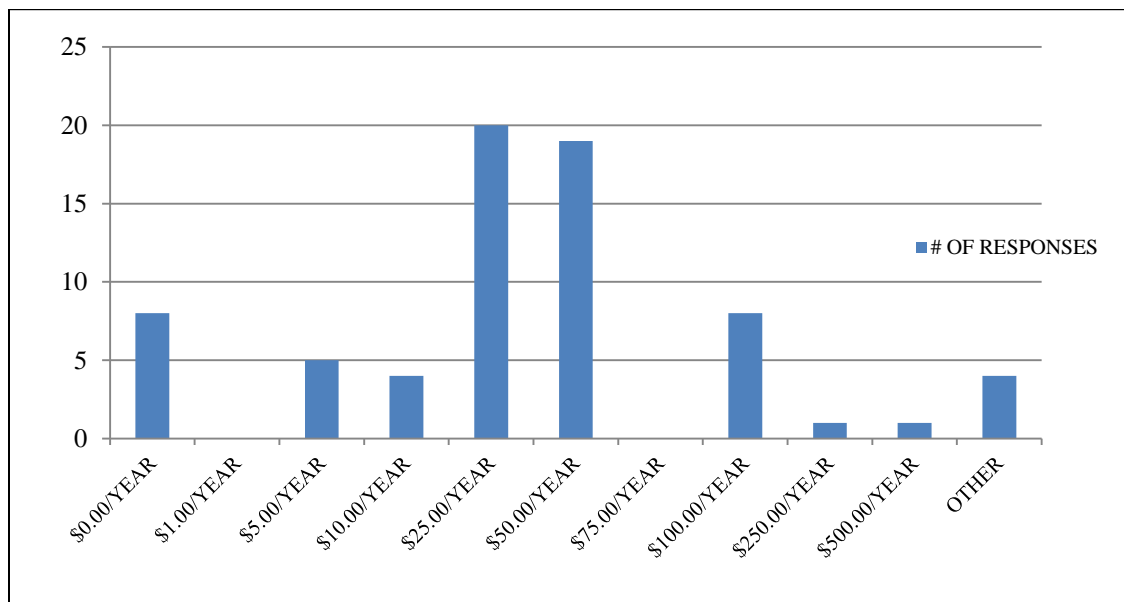


Figure 3. distribution of willingness to pay to maintain RHDGC (n = 70).

Table 3. WTP and willingness to change behavior.

Average WTP for Annual RHDGC Maintenance (n = 70)	\$44.07
Percent with WTP > 0 (n = 70)	88.6%
Percent Willing to Change their Behavior to Offset Environmental Impacts (n = 67)	97.0%

Table 4. reason(s) not willing to donate more than indicated (n = 68).

	Number of Responses	% *
I cannot afford to give more.	33	48.5
Other ( <i>please specify</i> )	24	35.3
I do not want to make annual donations.	9	13.2
I would rather give money to environmental preservation/conservation as a whole, instead of protecting a specific disc golf course.	7	10.3
I do not want to make annual donations, but I would be willing to make a one-time donation in the amount of \$_____.	6	8.8
I should not have to pay to conserve the RHDGC.	4	5.9
I do not believe that disc golf negatively impacts the environment, or that the activity of disc golf will degrade the quality of RHDGC experience, and feel no need to maintain the course.	4	5.9
The existence of disc golf courses in WNC is not important to me.	1	1.5
I do not believe that maintaining RHDGC will benefit me.	0	0
I do not believe disc golf courses should be maintained.	0	0
* Note: percentages add up to greater than 100% because respondents were allowed to indicate more than one response.		

As well as asking players if they would be willing to pay to maintain RHDGC, the survey also asked who they would prefer to manage such funds if they were collected. The respondents strongly indicated, with an 80.8% majority, that they would prefer “a private disc golf organization” to manage funds if they were collected (n = 68). “A private conservation organization” was the players’ second choice for fund management (see Table 5). For this question players were asked to select only one organizational group, however, some gave more than one, which is why percentages in Table 5 add up to more than 100%.

Table 5. preferred fund management organization (n = 73).

A Private Disc Golf Organization	80.8%
A Private Conservation Organization	20.5%
A City or County Government Agency	6.8%
Other	6.8%

In addition to WTP, this part of the survey asked players about their willingness to change behavior to offset some of their environmental impact while playing disc golf. A vast majority of respondents, 97%, said they would be willing to change their behavior in order to help offset environmental damages (n = 67) (Table 2). The two behavioral modifications that players were most willing to make were being cautious of vegetation and undergrowth when stepping off the trail is necessary, and refraining from using trees as practice baskets. The behavioral modifications that players were least likely to make were: refraining from playing when the course is wet, refraining from dragging equipment bags, and staying on the trail.

## 6. Discussion

On average, players reported being willing to donate \$44.07 annually in support of maintenance at RHDGC; almost 89% of respondents indicated a WTP greater than zero. Having a WTP greater than zero indicates that respondents

place a positive value on maintaining RHDGC. There was a study conducted in West Virginia (WV) that has results comparable to this research; however, the other study examined users' WTP per day to play at their favorite course, whereas this study asked about users' annual WTP for course maintenance. Results of the WV study reveal that players are willing to pay between \$1 and \$11, with 12% not being willing to pay to play<sup>10</sup>. If these results are accurate and we apply them to course use at Richmond Hill, players indicated that they play on average 81 days per year, then this would mean that players are willing to donate anywhere from \$81 to \$891. Thus, if the survey at RHDGC asked players about daily WTP instead of annual, it is likely they would report an amount that totals to far more than \$44 per year when multiplied by their use. It is possible that framing the question as a per-day fee versus an annual one is the key to the difference in results; when giving a per-day estimate the player is probably not thinking about how much it will add up to in a year. Though these studies reveal somewhat different results about the amount users are willing to contribute, they both show that players value their course positively.

One reason the players value course maintenance positively may be a reflection of the amount of time they spend playing disc golf at RHDGC. Players responded that they spend about 81 days per year at RHDGC, and approximately 122 days per year playing disc golf in general. This high level of activity indicates that disc golfers are very passionate for their sport, and their willingness to travel over 20 miles on average to get to RHDGC reveals their passion for this course specifically. Moreover, if players are traveling this far, this often, then they are spending a considerable amount of money on gasoline. Using the average U.S. fuel economy for 2012, players traveling 20 miles to RHDGC (i.e. 40 miles roundtrip) are spending approximately \$6 on gas each time they play<sup>26</sup>. If players are making this trip on average 81 times per year, then this adds up to about \$486.00. This amount spent on fuel further demonstrates how much disc golfers value the RHDGC.

Another reason respondents may have placed a positive WTP on course maintenance could be a result of their residency. The majority of players, almost 96%, indicated that they live in either Asheville or WNC; because these players are local to the area, they may feel a greater attachment and sense of stewardship for RHDGC than would out-of-towners. Additionally, respondents have been visiting and/or living in WNC for approximately 16 years on average; it is likely that this length of time allowed individuals to become more attached to the site and the region in general, which increases the likelihood they would want to maintain RHDGC for future enjoyment<sup>20</sup>.

Players were asked why they would not be willing to donate more annually toward the maintenance of RHDGC, and the most popular reason to not give more than indicated was because players could not afford to. The second most popular response to this question was more revealing about players' true feelings toward the maintenance of RHDGC. Many respondents chose the "other" option for this question, and when asked to specify why they would not be willing to donate more, their response was that they would be more willing to donate their time toward maintenance than their money. Players' willingness to contribute their time, which is arguably more valuable than a once-per-year donation, shows dedication to the Richmond Hill course and/or player income constraints. Time can be worth more than a donation for the simple fact that it costs money to pay people to do the jobs volunteers can do for free, such as spreading mulch, repairing trails, and/or clearing downed trees.

When the players were asked about whom they would prefer to manage maintenance funds if collected, an overwhelming 80.8% said that they would prefer a private disc golf organization to manage such funds. This response may have been influenced by the fact that the WNC Disc Golf Association currently collects player dues that are used to help with maintenance on courses throughout WNC, including RHDGC. Because the WNC Disc Golf Association has been trusted with managing funds in the past, it makes sense that players would feel comfortable with them handling maintenance funds presently. Moreover, there might be concern among players as to the reliability of government funding; players may be more trusting of their disc golf association than of government.

When asked about their awareness of environmental impacts of disc golf, the majority were aware (80%), however, a large portion of players (44.9%) were not concerned about these impacts. This differed from a previous study that found that players were generally unaware of the environmental effects of disc golf<sup>7</sup>. If more players were concerned about the impacts disc golf has on environment, this could lead to a higher WTP. However, income and education could also be a factor when discussing why the WTP is not higher than \$44.

Income likely influenced player WTP to support course maintenance as economic theory suggests a positive relationship between income and WTP<sup>21</sup>. Household income was estimated to be around \$49,535, while the 2011 NC mean for household income was \$43,326<sup>27</sup>. Because respondents on average earn a higher household income than the state mean, it is possible that the relatively higher earnings of the survey sample influenced their generally positive WTP to support course maintenance of RHDGC.

It is difficult to determine the influence that education has on WTP. It appears that WTP is higher for respondents without an education beyond a two-year degree, however, results change when the outlier of this group is removed.

Without the outlier, those with a bachelor's degree or beyond show the higher WTP. Because of these conflicting results, education's impact on WTP is ambiguous.

### 6.1 Limitations of the Research

As Ronald Coase once said, "It is inevitable that, at times, most of us will make mistakes in collecting data or drawing inferences from them"<sup>28</sup>. Thus, it only makes sense that there are limitations to this research. Because this survey only sampled 73 disc golfers, the survey results may be biased and may not represent all Richmond Hill disc golfers and park users. Since the City does not have data on user statistics, it is not possible to compare these results to the general user population of Richmond Hill Park. Because the survey was voluntary, self-selection bias may exist if those who chose to take the survey had differing opinions regarding RHDGC than those who chose not to take the survey. The survey may have included leading questions or respondents may have been misled or confused by questions, thus it is possible that response bias exists as well<sup>29</sup>.

The WTP question may be a source of bias as well, because it was posed to players as an annual donation. When the payment vehicle is represented by a donation, respondents may overbid if they think that the survey results will influence the maintenance of the resource in question<sup>25</sup>. This is where the issue of free-riders can become problematic; when the payment vehicle is in the form of a donation, respondents overestimate their WTP for maintenance through the survey. People will say they are willing to donate more than they actually would in the real world, despite the fact they may get to benefit from the maintenance that others contributed toward.

Another issue with the accuracy of CVM surveys is that they may not extract the true economic value from respondents if people get moral satisfaction or a "warm glow" from contributing voluntarily to the public good; the problem with this is that it tends to lead to overestimations of WTP values<sup>30</sup>.

### 6.2 Implications of Research

Results of this research imply several implications for course owners. The survey data suggests that players have a generally positive willingness to donate toward the conservation of RHDGC. An implication of this is that the City could use this information to create a fund specifically devoted to projects that would enhance the resilience of Richmond Hill in the presence of disc golf. Moreover, the results of this study could be helpful to other course owners who wish to implement a maintenance fund at their own course. The results of the survey that show players are willing to modify their behavior has important implications for all course owners, because they can create programs to educate players and/or post signage that will enhance players' awareness of the environmental damage they can cause and how to avoid it.

Disc golfers are known to be passionate recreators and the results of this study concur with this; players disc golf on average 121 days per year. Many players were willing to donate not just their money, but their time as well. An implication of this is that through advanced social networking (e.g. Facebook, Twitter, email, etc...) course owners could organize maintenance so that much of the physical labor is done by the players that use the course. This information is helpful for the city of Asheville, UNC-Asheville, private-property owners (e.g. campgrounds), and other communities for when making decisions surrounding proposed and existing disc golf courses.

## 7. Suggestions for Further Research

In this study, the WTP question was not given as a dichotomous choice for a single price, where each survey includes one of a few varying payment amounts distributed at random amongst players to draw more precise and truthful WTP responses<sup>20, 22</sup>. However, the study is dependent upon a reasonably large sample size from which meaningful trends in responses can be inferred. The WTP results from this study would be helpful in creating a larger-scale dichotomous choice CVM survey. A dichotomous question is one that can only be answered in one of two ways, such as 'agree' or 'disagree', 'true or false', 'A' or 'B', and 'yes' or 'no'<sup>31</sup>. Distribution of the bid values as indicated by participants could be used as a pre-test for future research on the value of disc golf course maintenance where the CV survey presents the WTP question as a closed-ended and single priced. It is commonly considered more dependable to present each respondent with a single price and ask if they are willing to pay for maintenance if it would cost them this same amount; this is the case because people are generally more familiar with evaluating their individual WTP for a good or service based on its marketed price<sup>20, 23</sup>.

Another way to get more accurate WTP responses may be to create a survey that asks about users' per-day willingness to donate rather than their annual willingness. Since it is easier to think about today than it is to think about a year from now, players may reveal an overall higher WTP once results are multiplied by the number of days

they use the course. In addition to asking players about their per-day WTP, the survey could use the travel cost method (TCM) of non-market valuation to infer the price of accessing RHDGC. TCM looks at the time and traveling expenses that people incur to go to a site, and then uses this information to place a “price” on access to the site<sup>32</sup>.

The results of this study revealed that many players would rather donate their time volunteering for maintenance of RHDGC than they would pay for it; this suggests that further research is needed to quantify players’ true willingness to pay for course maintenance by including questions about their willingness to volunteer. Another suggestion for the continuation of this research would be to survey an even larger sample population of Richmond Hill. In addition to a larger sample size, there should be a separate survey added to the research that addresses the recreators at Richmond Hill who do not play disc golf. It would be interesting to see if the non-disc golfing recreators at the Park value maintenance higher or lower than do the disc golfing ones. Also in future studies, the survey should be adapted to, and administered at, courses other than the RHDGC so that results could be compared.

Another possible study that could take place is one that estimates the economic impact of Richmond Hill on Asheville’s economy. A study of a disc golf course in Georgia found that the draw of large disc golfing events, such as Professional Disc Golf Association (PDGA) tournaments, generate as much as \$1.8 million in revenue for the community<sup>10</sup>. While a typical disc golf course will probably not come near this figure, there is still a positive economic impact that can be measured.

## **8. Conclusion**

As indicated by their positive WTP for course maintenance, disc golfers generally favor supporting the maintenance of the RHDGC. Public and private disc golf course owners alike should contemplate the value the courses hold to the players that use them when considering funding maintenance of proposed and existing courses. As demand for disc golf increases, the necessity to maintain these courses becomes greater. While there are negative environmental impacts associated with disc golf, these damages are not nearly as significant when compared to some other types of outdoor recreation. Thus, communities should know that players value disc golf courses positively and are willing to both pay for and modify their behavior to minimize impacts of the sport. Players’ willingness to pay for maintenance both monetarily and through behavior modification indicates their intense passion for their sport, and should be considered positively when the City is making decisions for the future of RHDGC. Additionally, the city should consider placing signage in the park that reminds people of how to decrease damage while playing. In a country where state budgets are becoming ever more constrained, it is important to know which public assets are worth the provision and which are not to the people that use them. Our world is full of underappreciated goods, but based on the results of this research RHDGC is not one of them.

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## 11. Appendix

### Appendix 1: Survey Instrument

1. Are you 18 years of age or older? *Circle one.*      Yes      No

*If you answered no to the above question, please do not continue and return the survey.*

2. How many days per year do you recreate at RHDGC? \_\_\_\_\_ days/year
3. Please estimate the number of days/year that you spend playing disc golf. \_\_\_\_\_ days/year
4. Is the majority of your disc golf activity at RHDGC? *Circle one.*      Yes      No
  - a. If so, how many days/year do you play disc golf at RHDGC? \_\_\_\_\_ days/year
  - b. If not, where do you usually play disc golf?
    - (1) \_\_\_\_\_ (2) \_\_\_\_\_ (3) \_\_\_\_\_
5. How far do you travel to get to the Richmond Hill Disc Golf Course? \_\_\_\_\_ miles
6. What is your *typical* mode of transportation to get to Richmond Hill? *Check one.*
  - \_\_\_\_ Car
  - \_\_\_\_ Bicycle
  - \_\_\_\_ Walk
  - \_\_\_\_ Other (*please specify*) \_\_\_\_\_
7. If you are from out-of-town, how many days per year do you travel to RHDGC to play disc golf? \_\_\_\_\_ days/year

On average, how much do you spend on travel expenses when you make a trip to RHDGC (*e.g. transportation, dining, and entertainment costs*)?

\$ _____ Transportation	\$ _____ Entertainment
\$ _____ Dining	\$ _____ Other
\$ _____ Lodging	\$ _____ Total

8. What is your favorite disc golf course in Western North Carolina?

Why is it your favorite?

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**Studies have shown that the sport of disc golf has some negative environmental implications such as soil compaction, soil erosion, undergrowth damage, and tree damage. These studies have also shown that many people are unaware of these environmental impacts. Most of the adverse implications associated with disc golf can be offset by simple mitigation techniques and behavioral modifications.**

9. Were you aware of the environmental impacts of disc golf before this survey? *Circle one.*
  - Yes      No
10. Are you concerned about the environmental impacts of disc golf? *Circle one.*
  - Yes      No

11. What is the maximum amount you would be willing to donate annually to support the maintenance of RHDGC?

*Check one.*

<input type="checkbox"/> \$0.00/year	<input type="checkbox"/> \$25.00/year	<input type="checkbox"/> \$250.00/year
<input type="checkbox"/> \$1.00/year	<input type="checkbox"/> \$50.00/year	<input type="checkbox"/> \$500.00/year
<input type="checkbox"/> \$5.00/year	<input type="checkbox"/> \$75.00/year	Other ( <i>please specify</i> ):
<input type="checkbox"/> \$10.00/year	<input type="checkbox"/> \$100.00/year	\$ _____/year

12. For what reason(s) would you not be willing to donate more than indicated?

*You may check more than one.*

- ☐ I do not want to make annual donations.
- ☐ I do not want to make annual donations, but I would be willing to make a one-time donation in the amount of \$\_\_\_\_\_.
- ☐ I should not have to pay to conserve the RHDGC.
- ☐ I cannot afford to give more.
- ☐ I would rather give money to environmental preservation/conservation as a whole, instead of protecting a specific disc golf course.
- ☐ I do not believe that disc golf negatively impacts the environment, or that the activity of disc golf will degrade the quality of RHDGC experience, and feel no need to maintain the course.
- ☐ The existence of disc golf courses in Western North Carolina is not important to me.
- ☐ I do not believe that maintaining RHDGC will benefit me.
- ☐ I do not believe disc golf courses should be maintained.

Other (*please specify*):

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13. If funds were collected to support maintenance of RHDGC, which group would you prefer to manage the funds?

☐ A private conservation organization. (*Hypothetical Example: Friends of Richmond Hill*)

☐ A private disc golf organization. (*Example: NC Disc Golf Club*)

☐ A City or County government agency.

Other (*please specify*): \_\_\_\_\_

14.

a. Would you be willing to change your behavior in order to offset some of the negative impacts of disc golf?  
*Circle one.*

Yes      No

b. Which of the following actions would you be willing to take in order to offset some of the environmental impacts associated with disc golf? *Check all that apply.*

- ☐ stay on the trail
- ☐ refrain from dragging equipment bags
- ☐ refrain from using trees as practice tees
- ☐ refrain from playing when course is wet
- ☐ be cautious of vegetation and undergrowth when you must step off the trail
- ☐ other

If you are not willing to change your behavior, why?

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15. Do you visit Richmond Hill for recreational activities other than disc golf? *Check all that apply.*

☐ hiking

☐ biking



\_\_\_\_\_dog-walking \_\_\_\_\_trail-running \_\_\_\_\_other activity(s) (please specify)  
\_\_\_\_\_

16. In what year were you born? \_\_\_\_\_

17. What is your gender? \_\_\_\_\_

18. What is your zip code? \_\_\_\_\_

19. How long have you been living in or visiting WNC? \_\_\_\_\_

20. What is the highest level of education that you have completed? *Check one.*

\_\_\_\_\_ Grade School

Other graduate degree (please specify): \_\_\_\_\_

\_\_\_\_\_ High School

\_\_\_\_\_ Associate's Degree (A.A. or A.S.)

Other (please specify): \_\_\_\_\_

\_\_\_\_\_ Bachelor's Degree (B.A. or B.S.)

\_\_\_\_\_ Master's Degree (M.A. or M.S.)

21. What is your annual household income? *Check one.*

\_\_\_\_\_ \$0 - \$14,999

\_\_\_\_\_ \$80,000 - \$99,999

\_\_\_\_\_ \$15,000 - \$ 29,999

\_\_\_\_\_ \$100,000 - \$119,999

\_\_\_\_\_ \$30,000 - \$44,999

\_\_\_\_\_ \$120,000 - \$139,999

\_\_\_\_\_ \$45,000 - \$59,999

\_\_\_\_\_ More than \$140,000

\_\_\_\_\_ \$60,000 - \$79,999

22. Do you regularly participate in any of the following recreational activities? *Check all that apply.*

\_\_\_\_\_ Hunting

\_\_\_\_\_ Canoeing/Kayaking/Rafting

\_\_\_\_\_ Skiing/Snowboarding

\_\_\_\_\_ Hiking/Backpacking

\_\_\_\_\_ Horseback Riding

\_\_\_\_\_ Boating/Sailing

\_\_\_\_\_ Walking/Running

\_\_\_\_\_ Rock Climbing

\_\_\_\_\_ Camping

\_\_\_\_\_ Bicycling/Mountain Biking

Other (please specify): \_\_\_\_\_